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AF/2121

PATENT APPLICATION

ATTORNEY DOCKET NO. 10992193-1

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IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Evan Kirshenbaum et al.

Confirmation No.: 5814

Application No.: 09/847,869

Examiner: Davis G.

Filing Date: 5-2-2001

Group Art Unit: 2121

Title: DERIVING A GENOME REPRESENTATION FOR EVOLVING GRAPH STRUCTURE WEIGHTS

Mail Stop Appeal Brief-Patents
Commissioner For Patents
PO Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL OF APPEAL BRIEF

Sir:

Transmitted herewith in **triplicate** is the Appeal Brief in this application with respect to the Notice of Appeal filed on **6-21-04**.

The fee for filing this Appeal Brief is (37 CFR 1.17(c)) $330.00.

(complete (a) or (b) as applicable)

The proceedings herein are for a patent application and the provisions of 37 CFR 1.136(a) apply.

(X) (a) Applicant petitions for an extension of time under 37 CFR 1.136 (fees: 37 CFR 1.17(a)-(d) for the total number of months checked below:

(X)	one month	$110.00
( )	two months	$420.00
( )	three months	$950.00
( )	four months	$1480.00

( ) The extension fee has already been filled in this application.

( ) (b) Applicant believes that no extension of time is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

Please charge to Deposit Account **08-2025** the sum of **$440.00**. At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account 08-2025 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 08-2025 under 37 CFR 1.16 through 1.21 inclusive, and any other sections in Title 37 of the Code of Federal Regulations that may regulate fees. A duplicate copy of this sheet is enclosed.

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Typed Name: **Paul H. Horstmann**

Signature: Paul H. Horstmann

Respectfully submitted,

Evan Kirshenbaum et al.

By Paul H. Horstmann

Paul H. Horstmann

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of:	
Evan Kirshenbuam et al.	Examiner: Davis G.
Application No: 09/847,869	Art Unit: 2121
Filed: 5-2-2001	
For: DERIVING A GENOME REPRESENTATION FOR EVOLVING GRAPH STRUCTURE WEIGHTS	

Commissioner for Patents
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Alexandria, VA 22313-1450

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Date of Deposit

Paul H. Horstmann
Name of Person Mailing Correspondence

Paul H/A 9-21-04
Signature Date

Appellant's Brief (Pursuant to 37 C.F.R. §1.192)

Dear Sir:

Applicant/ Appellant submits this Appeal Brief in connection with the above-referenced patent application which is on appeal to the Board of Patent Appeals and Interferences.

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REAL PARTY IN INTEREST

The real party in interest in this application is Hewlett-Packard Development Company, L.P.

RELATED APPEALS AND INTERFERENCES

Appellant is unaware of any other related appeals or interferences that may directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

STATUS OF THE CLAIMS

Claims 1-13 and 26-30 stand rejected under 35 U.S.C. §112, first paragraph.[1]

Claims 1-30 stand rejected under 35 U.S.C. §101.

Appellant appeals the rejection of all of the pending claims 1-30. Claims 1-30 as currently pending are set forth in the attached Appendix.

STATUS OF AMENDMENTS

Appellant is unaware of any amendments filed after the Final Office Action mailed March 19, 2004 which finally rejected claims 1-30.

[1] The Examiner in effect has stated that the enablement requirement of 35 U.S.C. §112, first paragraph, is not satisfied with respect to claims 1-13 and 26-30 by rejecting claims 1-13 and 26-30 "as containing subject matter which has not been described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention." (Page 2, paragraph 1, Office Action, 3/19/04). See MPEP 8 §706.03(c). The Examiner employed form paragraph 7.31.02 of MPEP 8 which has been superceded by form paragraph 7.31.02 of MPEP 8.2.

SUMMARY OF THE INVENTION

Claims 1-30 are directed to designing a graph structure using genetic programming technology. (See Appellant's specification, page 3, first two paragraphs). The invention of claims 1-30 improves prior genetic programming techniques for evolving a graph structure by employing a novel genome representation for evolving the weights for the arcs in a graph structure such that the arcs that participate in a substructure of the graph structure are in a close proximity in the genome representation. (See Appellant's specification, page 3, second paragraph). A process for designing a graph structure using a genome representation according to claims 1-30 decreases computational time on a hardware system employed in designing a graph structure, thereby decreasing the design cost of a graph structure. (See Appellant's specification, page 13, second to last paragraph of the description).

ISSUES PRESENTED

I: Whether the enablement requirement of 35 U.S.C. §112, first paragraph, is satisfied with respect to claims 1-13 and 26-30.

II: Whether claims 1-30 recite statutory subject matter.

GROUPING OF CLAIMS

Claims 1-13 and 26-30 stand together (Group I). Claims 14-25 stand together (Group II).

ARGUMENT

I: Appellant's specification satisfies the enablement requirement of 35 U.S.C. §112, first paragraph, with respect to claims 1-13 and 26-30 because Appellant's specification discloses a method for making and using the invention of claims 1-13 and 26-30.

As long as the specification discloses at least one method for making and using a claimed invention then the enablement requirement is satisfied. In re Fisher, 166 USPQ 18, 24 (CCPA 1970)[2]. Appellant's specification satisfies the enablement requirement of 35 U.S.C. §112, first paragraph, because it discloses at least one method for making and using the invention of claims 1-13 and 26-30. Claims 1-13 and 26-30 recite processor-based method steps for designing structures using a novel genome representation and Appellant's specification provides that

> A variety of hardware systems including general purpose computer systems and specialized systems may be employed to automatically design a desired structure by deriving a genome representation according to the present teachings.

(Appellant's specification, page 13, second paragraph).

The Examiner has stated that

> Claims 1 and 26 recite "A processor-based" while the specification, page 13, second paragraph recites "A varieties [sic] of hardware systems including general purpose computer systems and specialized systems **may be** employed". From the phrase "may be" the specification indicates that there is a possibility that the claimed steps of the invention can be implemented without a general purpose computer.

(Page 2, paragraph 1, Office Action, 3/19/04) (emphasis original).

Appellant submits that the possibility that claimed steps may be implemented without a general purpose computer does not disable one skilled in the art from making or using the invention claimed in claims 1-13 and 26-30 using general purpose computer systems or specialized systems as described in Appellant's specification. The Federal Circuit has held that a failure to disclose other methods by which a claimed invention may be made

does not render a claim invalid under 35 U.S.C. §112. Spectra-Physics, Inc. v. Coherent, Inc., 3 USPQ2d 1737, 1743 (Fed. Cir. 1987).

[2] See also MPEP §2164.01(b).

II: Claims 1-30 recite statutory subject matter because claims 1-30 recite a new and useful improvement to a process for genetic programming.

Section 101 of title 35, United States Code, provides that

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefore, subject to the conditions and requirements of this title.

(35 U.S.C. §101) (emphasis added).

Appellant respectfully submits that claims 1-30 recite statutory subject matter because claims 1-30 recite a new and useful improvement to a process[3] for designing a graph structure using genetic programming technology.

[3] Claims 1-13 and 26-30 actually recite a "method" rather than a process. However, a process is defined as a "process, art, or method, and includes a new use of a known process..." (35 U.S.C. 100(b) (emphasis added). Claims 14-25 recite a computer readable storage medium that holds a program that that when executed performs the method steps of claims 1-13.

A. Claims 1-7 and 14-19 recite a new and useful improvement to a process for designing a graph structure using genetic programming.

Appellant respectfully submits that claims 1-7 and 14-19 recite statutory subject matter because claims 1-7 and 14-19 recite a new and useful improvement to a process for designing a graph structure using genetic programming technology. Prior genetic programming techniques evolve a solution to a problem[4] by iteratively generating populations of child organisms by combining genetic material from parent organisms of previous generations. (See Appellant's specification, page 1, fourth paragraph). The invention of claims 1-7 and 14-19 improves prior genetic programming techniques for evolving a graph structure by "determining a genome representation for evolving the weights for the arcs in a graph structure such that the arcs that participate in a substructure of the graph structure are in a close proximity in the genome representation." A process for evolving a graph structure using a genome representation according to claims 1-7 and 14-19 is useful because it decreases computational time on a hardware system employed in designing a graph structure, thereby decreasing the design cost of a graph structure. (See Appellant's specification, page 1-2 and 13).[5]

The Examiner has stated that

> Applicant argues... that the claims have the practical application of "decreasing the time and cost of designing a graph structure". However, the claim [sic] invention and the practical application is not implemented by a computer (see specification, page 1, second paragraph)[6].

(Page 3, paragraph numbered 3, Office Action, 3/19/04) (emphasis original).

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[4] A solution to a problem in genetic programming is referred to as an organism. An organism in the context of claims 1-7 and 14-19 is a graph structure (See Appellant's specification, page 1, second and fourth paragraphs).

[5] For example, Appellant's specification on page 13 provides that "The present techniques decrease the computational time on the hardware system employed to automatically determine the genome representation and automatically evolve the weights."

The section of the specification cited by the Examiner is as follows

> A variety of disciplines including computer science commonly express solutions to problems in the form of graph structures. For example, neural networks which are commonly used in computer-related applications may be expressed in the form of graph structures.

(Appellant's specification, page 1, second paragraph).

Appellant submits that this section of the specification cited by the Examiner only serves to illustrate the usefulness of Appellant's invention in computer-related applications. Moreover, claims 1-7 clearly recite a "processor-based" method. Furthermore, claims 14-19 recite a computer readable storage media that holds a program that when executed causes a computer system to perform a new and useful process for evolving a graph structure using genetic programming.

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[6] Appellant can only speculate that the Examiner is again attempting to negate Appellant's teaching of a computer-based process because Appellant's specification uses the words "may be."

B. Claims 8-13 and 20-25 recite a new and useful improvement to a process for designing a graph structure using genetic programming.

Appellant respectfully submits that claims 8-13 and 20-25 recite statutory subject matter because claims 8-13 and 20-25 recite a new and useful improvement to a process for designing a graph structure using genetic programming technology. The invention of claims 8-13 and 20-25 improves prior genetic programming techniques for evolving a graph structure by "deriving a genome representation for evolving a set of weights in a graph structure...such that the weights that participate in the substructure are in a close proximity in the genome representation." A process using a genome representation according to claims 8-13 and 20-25 is useful because it decreases computational time on a hardware system employed in designing a graph structure, thereby decreasing the design cost of a graph structure. (See Appellant's specification, page 1-2 and 13).

In addition, claims 20-25 recite a computer readable storage media that holds a program that when executed causes a computer system to perform a new and useful process for evolving a graph structure using genetic programming.

C. Claims 26-30 recite a new and useful improvement to a process for designing a graph structure representing a neural network using genetic programming.

Appellant respectfully submits that claims 26-30 recite statutory subject matter because claims 26-30 recite a new and useful improvement to a process for designing a graph structure representing a neural network using genetic programming. The invention of claims 26-30 improves prior genetic programming techniques for designing a neural network by "determining a genome representation for a set of weights for a graph structure representing the neural network such that a set of arcs of the graph structure that participate in a substructure of the graph structure are in a close proximity in the genome representation." A process using a genome representation according to claims 26-30 is useful because it decreases computational time on a hardware system employed in designing a neural network, thereby decreasing the design cost of a neural network. (See Appellant's specification, page 1-2 and 13).

The Examiner has stated that

> Applicant further argues... that claim 26 recite neural network [sic]. However, neural network is recited in preamble and in the specification, page 1 as a may be[7] statement [sic] and as a related art example[8] and there is no indication as to how the neural network are able [sic] to implement claim 26 method steps.

(Page 3, paragraph numbered 3, Office Action, 3/19/04) (emphasis original). Appellant respectfully submits that claim 26 recites a "method for designing a neural network" using a set of processor-based steps rather than a method that is implemented by a neural network as stated by the Examiner. A neural network is the product of a method according to claim 26 rather than a

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[7] Appellant has already shown that the words "may be" do not negate a teaching in the specification.

[8] A neural network is not a related art example as stated by the Examiner. Instead, Appellants specification clearly sets forth the usefulness of Appellant's invention in the design of a neural network. For example, the graph structure 200 shown in Figure 3 of Appellant's specification represents a neural network. (See the text description of Figure 3 on page 6 of Appellant's specification).

performer of the method steps of claim 26. (See Appellant's specification, page 1, second paragraph).

D. The Examiner erred in stating that claims 1-30 recite a mathematical algorithm without any limitation to a practical application.

The Examiner has stated that claims 1-30 recite a mathematical algorithm without any limitation to a practical application. (Page 3, second paragraph, Office Action, 3/19/04). The Examiner did not cite any language in claims 1-30 or any authority in support of the above statement.

The Court of Appeals for the Federal Circuit has recently held in AT&T Corp. v. Excel Communications, Inc., 50 USPQ2d 1447 (Fed. Cir. 1999) that the judicially-defined proscription against patenting of a mathematical algorithm, to the extend such a proscription still exists, is narrowly limited to mathematical algorithms in the abstract (citing State Street Bank & Trust Co. v. Signature Fin. Group, Inc., 47 USPQ2d 1596, 1602 (Fed. Cir. 1998)) and that unpatentable mathematical algorithms are identifiable by showing that they are merely abstract ideas constituting disembodied concepts or truths that are not useful. (State Street at 1601). The Federal Circuit has also held that the Supreme Court never intended to create an overly broad fourth category[9] of mathematical subject matter that is excluded from patentability under §101 but instead intended to simply explain that certain types of mathematical subject matter standing alone represent abstract ideas until reduced to some type of practical application. In re Alappat, 31 USPQ2d 1545, 1556-57 (Fed. Cir. 1994). Thus, a proper[10] analysis of a claimed invention under 35 U.S.C. §101 requires an examination of a claimed invention to see if the claimed subject matter as a whole is a disembodied mathematical concept representing a law of nature or an abstract idea or if the mathematical concept has been reduced to some practical application rendering it useful. Id at 1557.

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[9] It is well settled that three categories of subject matter - laws of nature, natural phenomena, and abstract ideas - are non-statutory under 35 U.S.C. §101. Diamond v. Diehr, 450 U.S. 175, 185 (1981).

[10] Appellant submits that the Examiner employed an improper, limited, and outdated analysis of whether claims 1-30 are statutory.

Appellant respectfully submits that the subject matter of the invention of claims 1-25 taken as a whole[11] recite a practical application of genetic programming technology to the problem of designing a graph structure. In addition, the invention of claims 1-25 improves prior genetic programming techniques by decreasing computational time on a hardware system employed in designing a graph structure and consequently decreases the design cost of a graph structure. (See Appellant's specification, page 1-2 and 13).

In addition, Appellant respectfully submits that the subject matter of the invention of claims 26-30 taken as a whole recite a practical application of genetic programming technology to the problem of designing a neural network. It is also submitted that the invention of claims 26-30 decreases the computational time on a hardware system employed in designing a neural network and thereby decreases the design cost of a neural network in comparison to prior art genetic programming technology. (See Appellant's specification, page 1-2 and 13).

[11] Although claims 1-25 do not explicitly recite the limitation of "genetic programming," claims 1-25 do recite the limitation of "evolving" which is a key step in genetic programming. (See page 1 of Appellant's specification). Moreover, Appellant's specification taken as a whole makes it clear that Appellant's invention is a new and useful improvement to genetic programming technology. (See Appellant's specification, pages 1-3 and 5-7).

E. The Examiner performed an improper, limited, and outdated analysis of whether claims 1-30 are statutory.

The Patent Office's Examination Guidelines for Computer-Related Inventions (Guidelines) state that

> Office personnel will no longer begin examination by determining if a claim recites a "mathematical algorithm." Rather they will review the complete specification, including the detailed description of the invention, any specific embodiments that have been disclosed, the claims and any specific substantial, and credible utilities that have been asserted for the invention.

(MPEP 8.2 §2106(II)). (emphasis original).[12] Appellant submits that the Examiner did not review the complete specification including the teachings in the specification that clearly set forth the context of Appellant's claimed invention in the technology of genetic programming. It is submitted that the Examiner instead focused his attention on the language in claims 1-30 that recite mathematical elements, e.g. graph structures and matrices, and then formulated an outdated "mathematical algorithm" rejection. Appellant's assertion that the Examiner focused only on the mathematical terminology in the claims is supported by the fact that the Examiner did not cite any prior art pertaining to genetic programming.[13] Instead, the Examiner cited a pair of theoretical papers pertaining to graph structures both of which are heavily laden with mathematical formulas. (See the Notice of References Cited attached to the Office Action mailed 8/13/2003).

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[12] This cited section of the Examination Guidelines brings Patent Office examining procedures into line with recent case law that shrinks the proscription against patenting mathematical algorithms. Indeed, the Federal Circuit has recently wondered aloud whether a proscription against patenting a "mathematical algorithm" still exists after State Street. See AT&T Corp. v. Excel Communications, Inc., 50 USPQ2d 1447 (Fed. Cir. 1999).

[13] The prior art in genetic programming technology includes a number of U.S. Patents including U.S. Patent No: 5,136,686 of *Koza*.

The Guidelines further provide that

> Office personnel have the burden to establish a *prima facie* case that the claimed invention as a whole is directed to solely an abstract idea or to manipulation of abstract ideas or does not produce a useful result. Only when the claim is devoid of any limitation to a practical application in the technological arts should it be rejected under 35 U.S.C. §101.

(MPEP 8.2 §2106(II)(A)) (emphasis original) and that

> Further, when such a rejection is made, Office personnel must expressly state how the language of the claims has been interpreted to support the rejection.

(MPEP 8.2 §2106(II)(A)). (emphasis added).

The Examiner did not state expressly how the language of claims 1-30 were interpreted. The Examiner's entire statement of his grounds for rejecting claims 1-30 under 35 U.S.C. §101 is as follows

> Claims 1-30 recite mathematical algorithm [sic] without any limitation to a practical application. Therefore, the claimed invention is directed to non-statutory subject matter.

(Page 3, second paragraph, Office Action, 3/19/04). For example, the Examiner did not state his interpretation of the terms "evolving" or "genome representation" that appear in claims 1-30.

CONCLUSION

Appellant respectfully submits that the stated rejections cannot be maintained in view of the arguments set forth above. Appellant respectfully submits that all of the claims 1-30 are patentable under 35 U.S.C. §§101, 112 over the references cited by the Examiner and requests that the Board of Patent Appeals and Interferences direct allowance of the rejected claims.

Respectfully submitted,

By

Date: 9-21-04

Paul H. Horstmann
Reg. No. 36,167

APPENDIX

1. A processor-based method for evolving a graph structure comprising determining a genome representation for evolving a set of weights for a set of arcs in the graph structure such that the arcs that participate in a substructure of the graph structure are in a close proximity in the genome representation.

2. The method of claim 1, further comprising evolving the weights using the genome representation.

3. The method of claim 1, wherein determining a genome representation comprises determining a matrix which indicates an optimal arrangement of the weights in the genome representation in response to the interconnections among a set of nodes and the arcs of the graph structure.

4. The method of claim 3, wherein determining a matrix comprises:
determining a connection matrix which indicates interconnections among the nodes and the arcs;

determining a weight matrix which indicates an amount by which each element of the weight matrix is off a diagonal;

determining a product matrix of the connection matrix and the weight matrix.

5. The method of claim 4, wherein determining a matrix further comprises determining a score by summing a set of elements of the product matrix.

6. The method of claim 5, further comprising minimizing the score by swapping one or more rows and columns of the matrix.

7. The method of claim 1, wherein the graph structure is a neural network.

8. A processor-based method for deriving a genome representation for evolving a set of weights in a graph structure, comprising:

determining a substructure of the graph structure;

determining an arrangement in the genome representation such that the weights that participate in the substructure are in a close proximity in the genome representation.

9. The method of claim 8, wherein determining an arrangement comprises determining a matrix which indicates an optimal arrangement of the weights in the genome representation in response to the interconnections among a set of nodes and the arcs of the graph structure.

10. The method of claim 9, wherein determining a matrix comprises:

determining a connection matrix which indicates interconnections among the nodes and the arcs;

determining a weight matrix which indicates an amount by which each element of the weight matrix is off a diagonal;

determining a product matrix of the connection matrix and the weight matrix.

11. The method of claim 10, wherein determining a matrix further comprises determining a score by summing a set of elements of the product matrix.

12. The method of claim 11, further comprising minimizing score by swapping one or more rows and columns of the matrix.

13. The method of claim 8, wherein the graph structure is a neural network.

14. A computer-readable storage media that holds a program that when executed evolves a graph structure by determining a genome representation for evolving a set of weights for a set of arcs in the graph structure such that the arcs that participate in a substructure of the graph structure are in a close proximity in the genome representation.

15. The computer-readable storage media of claim 14, wherein determining a genome representation comprises determining a matrix which indicates an optimal arrangement of the weights in the genome representation in response to the interconnections among a set of nodes and the arcs of the graph structure.

16. The computer-readable storage media of claim 15, wherein determining a matrix comprises:

determining a connection matrix which indicates interconnections among the nodes and the arcs;

determining a weight matrix which indicates an amount by which each element of the weight matrix is off a diagonal;

determining a product matrix of the connection matrix and the weight matrix.

17. The computer-readable storage media of claim 16, wherein determining a matrix further comprises determining a score by summing a set of elements of the product matrix.

18. The computer-readable storage media of claim 17, further comprising minimizing the score by swapping one or more rows and columns of the matrix.

19. The computer-readable storage media of claim 14, wherein the graph structure is a neural network.

20. A computer-readable storage media that holds a program that when executed derives a genome representation for evolving a set of weights in a graph structure by:

determining a substructure of the graph structure;

determining an arrangement in the genome representation such that the weights that participate in the substructure are in a close proximity in the genome representation.

21. The computer-readable storage media of claim 20, wherein determining an arrangement comprises determining a matrix which indicates an optimal arrangement of the weights in the genome representation in response to the interconnections among a set of nodes and the arcs of the graph structure.

22. The computer-readable storage media of claim 21, wherein determining a matrix comprises:

determining a connection matrix which indicates interconnections among the nodes and the arcs;

determining a weight matrix which indicates an amount by which each element of the weight matrix is off a diagonal;

determining a product matrix of the connection matrix and the weight matrix.

23. The computer-readable storage media of claim 22, wherein determining a matrix further comprises determining a score by summing a set of elements of the product matrix.

24. The computer-readable storage media of claim 23, further comprising minimizing score by swapping one or more rows and columns of the matrix.

25. The computer-readable storage media of claim 20, wherein the graph structure is a neural network.

26. A processor-based method for designing a neural network, comprising:

determining a genome representation for a set of weights for a graph structure representing the neural network such that a set of arcs of the graph structure that participate in a substructure of the graph structure are in a close proximity in the genome representation;

evolving the weights using the genome representation.

27. The method of claim 26, wherein determining a genome representation comprises determining a matrix which indicates an optimal arrangement of the weights in the genome representation in response to the interconnections among a set of nodes and the arcs of the graph structure.

28. The method of claim 27, wherein determining a matrix comprises:

determining a connection matrix which indicates interconnections among the nodes and the arcs;

determining a weight matrix which indicates an amount by which each element of the weight matrix is off a diagonal;

determining a product matrix of the connection matrix and the weight matrix.

29. The method of claim 28, wherein determining a matrix further comprises determining a score by summing a set of elements of the product matrix.

30. The method of claim 29, further comprising minimizing the score by swapping one or more rows and columns of the matrix.